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EXAMINER	
STACE, BRENT S	
ART UNIT	**PAPER NUMBER**
2161	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/611,291	PATTERSON, R. HUGO	
	Examiner	Art Unit	
	Brent S. Stace	2161	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-51* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-51* is/are rejected.

7)☒ Claim(s) *4-19, and 31-51* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *20060126*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remarks

1. Claims 1-51 have been examined. Claims 1-51 have been rejected. This document is the first Office action on the merits.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

3. Claims 4-19, and 31-51 are objected to because of the following informalities:

a. Claim 4 contains a grammatical error (subject/verb agreement) on line 3 with the citing of "include." This objection propagates downward through the dependant Claims 5-7. Since Claim 36 is substantially the same as Claim 4 and includes the same objection, Claim 36 is also objected to for the same reason, and this objection propagates downward through the dependant Claims 37-39.

b. Claim 7 contains poor sentence structure on lines 2-3 with the citing of "when the minimum value changes based the new locations of the copied blocks."

c. Claim 8 contains a typographical error on line 2 with the citing of "includes." There should be a colon after "includes" to indicate a list of limitations included. This objection propagates downward through the dependant Claims 9-14. Since Claim 40 is substantially the same as Claim 8 and includes the same objection, Claim 40 is also objected to for the same reason, and this objection propagates downward through the dependant Claims 41-46.

d. Claim 15 contains a typographical error on lines 2-4 with the citing of "performing the following...storage tree." There should be a colon after "storage tree" to indicate a list of limitations included. This objection propagates downward through the dependant Claims 16-19. Since Claim 47 is substantially the same as Claim 15 and includes the same objection, Claim 47 is also objected to for the same reason, and this objection propagates downward through the dependant Claims 48-51.

e. Claim 31 contains a typographical error on line 2 with the citing of "includes." There should be a colon after "includes" to indicate a list of limitations included. This objection propagates downward through the dependant Claim 32 32.

f. Claim 31 contains a typographical error on line 5 with the citing of "a set of one more storage devices." This objection propagates downward through dependant Claim 32. This informality also makes poor sentence structure.

g. Claim 33 contains poor sentence structure on lines 5-6 with the citing of "within the to an allocated segment of the log." This objection propagates downward through the dependant Claims 34-39.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 27-30, and 32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Claim 27 recites "a set of one or more storage trees" then later recites "said set of storage trees." This claim is indefinite because the claim recites "one or more," and appears to only recite, after the first citing, the multiple storage trees instance, thus, making the claim imply two separate interpretations. This rejection propagates downward through the dependant Claims 28-30. Claim 30 also recites "said set of storage trees." Therefore, Claim 30 is rejected for the same reasons as Claim 27.

7. Claim 27 recites "a set of one or more storage devices" then later recites "said set of storage devices." This claim is indefinite because the claim recites "one or more," and appears to only recite, after the first citing, the multiple storage devices instance, thus, making the claim imply two separate interpretations. This rejection propagates downward through the dependant Claims 28-30.

8. Claim 32 recites "the set of one or more storage trees" when Claim 31 (Claim 32's independent claim) only states "a set of trees." If the set from Claim 32 is one tree, Claim 31's set of trees, would make Claim 31 indefinite.

Claim Rejections - 35 USC § 101

9. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

10. Claims 1-19, and 31-51 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

11. Claims 1-7, 15-19, 33-39 and 47-51 are claims that do not meet the useful, concrete tangible result required for 35 U.S.C. 101. Specifically, Claim 1, 15, 33, and 47 recite no practical application or tangible result. This rejection is not remedied in any dependent claims, therefore, Claims 2-7, 15-19, 34-39, and 48-51 are rejected for the same reason.

12. Claims 8-14 and 40-46 are claims that do not meet the useful, concrete tangible result required for 35 U.S.C. 101. Specifically, Claim 8 and 40 recites no tangible result. This rejection is not remedied in any dependent claims, therefore, Claims 9-14 and 41-46 are rejected for the same reason.

13. Claims 31and 32 are claims that do not meet the useful, concrete tangible result required for 35 U.S.C. 101. Specifically, Claim 31 appears to be no more than a program per se. This rejection is not remedied in any dependent claim, therefore, Claim 32 is rejected for the same reason.

14. Claims 33-39, 40-46, and 47-51 are claims that do not meet the useful, concrete tangible result required for 35 U.S.C. 101. Specifically, the claims are not limited to tangible embodiments. In view of Applicant's disclosure, specification at page 9, paragraph [0033], the medium is not limited to tangible embodiments, instead being defined as including both tangible embodiments (e.g., disk storage) and intangible embodiments (e.g., carrier waves). As such, the claim is not limited to statutory subject matter and is therefore non-statutory. This rejection is not remedied in any dependent claims, therefore, Claims 34-39, 41-46, and 48-51 are rejected for the same reason.

15. To expedite a complete examination of the instant application, the Claims rejected under 35 U.S.C. 101 above are further rejected as set forth below in anticipation of applicant amending these Claims to place them within the four statutory categories of invention.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. Claims 1-17, 19-23, 25, 26, 33-49, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,249,792 (Zwilling et al.).

18. For **Claim 1**, Zwilling teaches: "A method comprising:

- locating blocks of data in a log that are referenced and within a range at a tail of the log" [Zwilling, col. 12, lines 24-53 with Zwilling, Fig. 2].

Zwilling discloses the above limitations but does not expressly teach in the same embodiment:

- "...copying the blocks of data that are referenced and within the range to an unallocated segment of the log."

With respect to Claim 1, Zwilling teaches in a different embodiment:

- "...copying the blocks of data that are referenced and within the range to an unallocated segment of the log" [Zwilling, col. 5, lines 34-52 with Zwilling, col. 12, lines 41-53].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the different embodiments of Zwilling because the invention is directed towards shrinking files.

Zwilling discloses an on-line dynamic file shrink facility comprising shrinking log files, however Zwilling does not expressly disclose in that same embodiment how it the shrinking is accomplished.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the copying of blocks and file shrinking process from Zwilling and install it into the shrinking log files of Zwilling, thereby offering the obvious advantage of shrinking log files to save space.

Even though Zwilling is only one reference being used to reject Claim 1, the rejection on Claim 1 is under 35 U.S.C. 103(a) because different embodiments of Zwilling are use

in the rejection for Claim 1 and its respective dependant claims. Zwilling teaches all of Claim 1 through Zwilling's different embodiments.

19. **Claim 2** can be mapped to Zwilling as follows: "The method of claim 1 comprising designating the range as unallocated" [Zwilling, col. 5, lines 34-52].

20. **Claim 3** can be mapped to Zwilling as follows: "The method of claim 1, wherein the blocks of data are associated with nodes in a storage tree within the log [Zwilling, cols. 8-9, lines 46-14] and wherein locating the blocks of data that are referenced and within the range includes determining a minimum value among addresses of descendent nodes of a node" [Zwilling, cols. 8-9, lines 46-14].

21. **Claim 4** can be mapped to Zwilling as follows: "The method of claim 3, wherein a location table includes an entry for nodes that reference other nodes [Zwilling, col. 8, lines 46-64 with Zwilling, col. 10, lines 5-13] and wherein determining the minimum value among addresses of descendent nodes of the node include retrieving the minimum value from an entry in the location table associated with the node" [Zwilling, cols. 8-9, lines 46-14 with Zwilling, col. 10, lines 5-13].

22. **Claim 5** can be mapped to Zwilling as follows: "The method of claim 4, wherein locating the blocks of data that are referenced and within the range includes processing the descendent nodes of the node upon determining that the minimum value among the addresses of the descent nodes is within the range" [Zwilling, col. 5, lines 29-52].

23. **Claim 6** can be mapped to Zwilling as follows: "The method of claim 5 comprising modifying the addresses of the copied blocks of data that are stored in the

location table based on the new locations of the copied blocks of data in the log" [Zwilling, Fig. 3C with Zwilling, col. 8, lines 29-33 with Zwilling, col. 9, lines 4-7].

24. **Claim 7** can be mapped to Zwilling as follows: "The method of claim 5 comprising modifying the minimum value in the entry in the table associated with the node when the minimum value changes based on the new locations of the copied blocks of data that are associated with descendent nodes of the node" [Zwilling, Fig. 3C with Zwilling, col. 8, lines 29-33 with Zwilling, col. 9, lines 4-7 with Zwilling, col. 5, lines 29-52 with Zwilling, col. 10, lines 5-13].

25. For **Claim 8**, Zwilling teaches: "A method comprising:

- garbage collection within a range of addresses in a storage system, [Zwilling, col. 12, lines 24-53 with Zwilling, Fig. 2] which includes"

Zwilling discloses the above limitations but does not expressly teach in the same embodiment:

- "...a plurality of storage trees having multiple references to the same block of data, by
- pruning walking of the plurality of storage trees to determine active blocks of data within said range, where active blocks of data are those still in one of the plurality of storage trees, by
    - determining, based on accessing in one of said plurality of storage trees a parent node that has a plurality of descendent nodes, that none of the plurality of descendant nodes are associated with blocks of data within the range; and

- skipping the walking of the plurality of descendent nodes based on said determining."

With respect to Claim 8, Zwilling teaches in a different embodiment:

- "...a plurality of storage trees having multiple references to the same block of data, [Zwilling, cols. 8-9, lines 46-17] by
- pruning walking of the plurality of storage trees to determine active blocks of data within said range, where active blocks of data are those still in one of the plurality of storage trees, [Zwilling, cols. 8-9, lines 46-17 with Zwilling, col. 5, lines 29-52 with Zwilling, col. 12, lines 24-40] by
  - determining, based on accessing in one of said plurality of storage trees a parent node that has a plurality of descendent nodes, that none of the plurality of descendant nodes are associated with blocks of data within the range; [Zwilling, col. 5, lines 29-52 with Zwilling, col. 12, lines 24-53 with Zwilling, col. 9, lines 56-65] and
- skipping the walking of the plurality of descendent nodes based on said determining" [Zwilling col. 5, lines 12-16].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the different embodiments of Zwilling because the invention is directed towards shrinking files.

Zwilling discloses an on-line dynamic file shrink facility comprising shrinking log files, however Zwilling does not expressly disclose in that same embodiment how it the shrinking is accomplished.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the copying of blocks and file shrinking process from Zwilling and install it into the shrinking log files of Zwilling, thereby offering the obvious advantage of shrinking log files to save space.

Even though Zwilling is only one reference being used to reject Claim 8, the rejection on Claim 8 is under 35 U.S.C. 103(a) because different embodiments of Zwilling are use in the rejection for Claim 8 and its respective dependant claims. Zwilling teaches all of Claim 8 through Zwilling's different embodiments.

26. **Claim 9** can be mapped to Zwilling as follows: "The method of claim 8, wherein the blocks of data are stored in a log and the range is a segment of the log" [Zwilling, col. 12, lines 15-53 with Zwilling, Fig. 2].

27. **Claim 10** can be mapped to Zwilling as follows: "The method of claim 9, wherein the segment is at the tail of the log" [Zwilling col. 5, lines 34-52].

28. **Claim 11** can be mapped to Zwilling as follows: "The method of claim 10, wherein the determining is performed by comparing a minimum offset of the plurality of descendent nodes against the range, [Zwilling, cols. 8-9, lines 46-15 with Zwilling, col. 9, lines 43-51 with Zwilling col. 8, lines 20-35] wherein the minimum offset is accessed when walking the parent node and without walking the plurality of descendent nodes" [Zwilling, cols. 8-9, lines 46-15 with Zwilling, col. 9, lines 43-51 with Zwilling col. 8, lines 20-35 with Zwilling, col. 7, lines 38-21].

29. **Claim 12** can be mapped to Zwilling as follows: "The method of claim 8, wherein the garbage collecting is further performed by:

- copying the active blocks of data out of the range; [Zwilling col. 5, lines 29-52] and
- marking the range as unallocated" [Zwilling col. 5, lines 29-52].

30. **Claim 13** can be mapped to Zwilling as follows: "The method of claim 12, wherein the range is a segment at the tail of a log and said copying is from the said segment at the tail to a segment at the head of the log" [Zwilling col. 5, lines 34-52 with Zwilling, Fig. 2].

31. **Claim 14** can be mapped to Zwilling as follows: "The method of claim 12, wherein said copying includes updating addresses of the copied blocks of data within a location table" [Zwilling, Fig. 3C with Zwilling, col. 8, lines 29-33 with Zwilling, col. 9, lines 4-7].

32. For **Claim 15**, Zwilling teaches: "A method comprising."

Zwilling discloses the above limitation but does not expressly teach in the same embodiment:

- "...performing the following until each block of data that is active in a range to be cleaned at a tail of a log of data is copied to a head of the log, wherein a block of data is associated with a node of a storage tree,
  - copying blocks of data associated with child nodes of a current node that are within the range to be cleaned to the head of the log;
  - retrieving a block of data associated with the current node, upon determining that a minimum address value among addresses of descendent nodes is within the range to be cleaned;

- designating, as the current node, one of the child nodes of the current node that is an interior node, upon determining that at least one child node is an interior node; and
- designating, as the current node, an ancestor node of the current node whose descendent nodes are unprocessed."

With respect to Claim 15, Zwilling teaches in a different embodiment:

- "...performing the following until each block of data that is active in a range to be cleaned at a tail of a log of data is copied to a head of the log, [Zwilling col. 5, lines 34-52 with Zwilling, Fig. 2 with Zwilling, col. 12, lines 15-17] wherein a block of data is associated with a node of a storage tree, [Zwilling, col. 10, lines 5-13 with Zwilling col. 8, lines 46-65]
  - copying blocks of data associated with child nodes of a current node that are within the range to be cleaned to the head of the log; [Zwilling col. 5, lines 34-52 with Zwilling, Fig. 2]
  - retrieving a block of data associated with the current node, upon determining that a minimum address value among addresses of descendent nodes is within the range to be cleaned; [Zwilling col. 5, lines 29-52 with Zwilling, Fig. 2]
  - designating, as the current node, one of the child nodes of the current node that is an interior node, upon determining that at least one child node is an interior node; [Zwilling, col. 8, lines 46-65] and

- designating, as the current node, an ancestor node of the current node whose descendent nodes are unprocessed" [Zwilling, col. 8, lines 46-65].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the different embodiments of Zwilling because the invention is directed towards shrinking files.

Zwilling discloses an on-line dynamic file shrink facility comprising shrinking log files, however Zwilling does not expressly disclose in that same embodiment how it the shrinking is accomplished.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the copying of blocks and file shrinking process from Zwilling and install it into the shrinking log files of Zwilling, thereby offering the obvious advantage of shrinking log files to save space.

Even though Zwilling is only one reference being used to reject Claim 15, the rejection on Claim 15 is under 35 U.S.C. 103(a) because different embodiments of Zwilling are use in the rejection for Claim 15 and its respective dependant claims. Zwilling teaches all of Claim 15 through Zwilling's different embodiments.

33. **Claim 16** can be mapped to Zwilling as follows: "The method of claim 15, wherein performing the following until each block of data that is active in the range to be cleaned at the tail of the log of data is copied to a head of the log includes updating addresses of that copied blocks of data within a location table" [Zwilling, col. 8, lines 21-46 with Zwilling, col. 9, lines 5-7].

34. **Claim 17** can be mapped to Zwilling as follows: "The method of claim 15, wherein performing the following until each block of data that is active in the range to be cleaned at the tail of the log of data is copied to the head of the log includes updating a minimum address value among addresses of descendent nodes for an entry for the current node in a location table where the minimum address value changes based on copying of the blocks of data associated with the descendent nodes of the current node" [Zwilling, cols. 8-9, lines 21-15 with Zwilling col. 8, lines 20-35 with Zwilling, col. 7, lines 38-21].

35. **Claim 19** can be mapped to Zwilling as follows: "The method of claim 15 comprising marking the range as unallocated when the blocks of data that are active and within the range are copied to the head of the log" [Zwilling, col. 5, lines 34-52].

36. For **Claim 20**, Zwilling teaches: "A system comprising:

- a storage device to store a number of blocks of data, [Zwilling, col. 5, lines 6-12] wherein the blocks of data that are marked as allocated are non-modifiable" [Zwilling, col. 6, lines 5-10].

Zwilling discloses the above limitation but does not expressly teach in the same embodiment:

- "...the blocks of data to be stored as a log; and
- a garbage collection logic to locate the blocks of data that are referenced and within a range at a tail of the log."

With respect to Claim 20, Zwilling teaches in a different embodiment:

- "...the blocks of data to be stored as a log; [Zwilling, col. 12, lines 15-17] and

- a garbage collection logic to locate the blocks of data that are referenced and within a range at a tail of the log" [Zwilling, col. 12, lines 24-53 with Zwilling, Fig. 2].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine the different embodiments of Zwilling because the invention is directed towards shrinking files.

Zwilling discloses an on-line dynamic file shrink facility comprising shrinking log files, however Zwilling does not expressly disclose in that same embodiment how it the shrinking is accomplished.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the copying of blocks and file shrinking process from Zwilling and install it into the shrinking log files of Zwilling, thereby offering the obvious advantage of shrinking log files to save space.

Even though Zwilling is only one reference being used to reject Claim 20, the rejection on Claim 20 is under 35 U.S.C. 103(a) because different embodiments of Zwilling are use in the rejection for Claim 20 and its respective dependant claims. Zwilling teaches all of Claim 20 through Zwilling's different embodiments.

37. **Claim 21** can be mapped to Zwilling as follows: "The system of claim 20, wherein the garbage collection logic is to copy the blocks of data that are referenced to an unallocated address space of the log" [Zwilling, col. 5, lines 29-52 with Zwilling, Fig. 2].

38. **Claim 22** can be mapped to Zwilling as follows: "The system of claim 21, wherein the garbage collection logic is to copy the blocks of data that are referenced to a head of the log" [Zwilling, col. 5, lines 29-52 with Zwilling, Fig. 2].

39. **Claim 23** can be mapped to Zwilling as follows: "The system of claim 20, wherein the garbage collection logic is to mark the range as unallocated" [Zwilling, col. 5, lines 29-52 with Zwilling, Fig. 2].

40. **Claim 25** can be mapped to Zwilling as follows: "The system of claim 20 comprising a location table to include entries associated with interior nodes of a storage tree, [Zwilling, col. 10, lines 5-13] wherein each entry is to include a minimum value among the addresses of descendent nodes of the associated interior node" [Zwilling, cols. 8-9, lines 46-15 with Zwilling, col. 9, lines 43-51 with Zwilling col. 8, lines 20-35 with Zwilling, col. 7, lines 38-21].

41. **Claim 26** can be mapped to Zwilling (as modified by) as follows: "The system of claim 25, wherein the garbage collection logic is to locate the blocks of data that are referenced and within the range at the tail of the log based on the minimum values stored in the entries of the location table" [Zwilling, col. 5, lines 29-40 with Zwilling, col. 8, lines 46-65 with Zwilling, col. 10, lines 5-13].

42. **Claims 33-39** encompass substantially the same scope of the invention as that of Claims 1-7, respectfully, in addition to a machine-readable medium and some instructions for performing the method steps of Claims 1-7, respectfully. Therefore, Claims 33-39 are rejected for the same reasons as stated above with respect to Claims 1-7, respectfully.

43. **Claims 40-46** encompass substantially the same scope of the invention as that of Claims 8-14, respectfully, in addition to a machine-readable medium and some instructions for performing the method steps of Claims 8-14, respectfully. Therefore, Claims 40-46 are rejected for the same reasons as stated above with respect to Claims 8-14, respectfully.

44. **Claims 47-49 and 51** encompass substantially the same scope of the invention as that of Claims 15-17 and 19, respectfully, in addition to a machine-readable medium and some instructions for performing the method steps of Claims 15-17 and 19, respectfully. Therefore, Claims 47-49 and 51 are rejected for the same reasons as stated above with respect to Claims 15-17 and 19, respectfully.

45. Claims 18, 24, 27-32 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,249,792 (Zwilling et al.) in view of U.S. Patent No. 5,963,962 (Hitz et al.).

46. For **Claim 18**, Zwilling teaches: "The method of claim 15."

Zwilling discloses the above limitation but does not expressly teach: "...wherein at least one block of data stored in the log is referenced by more than one of other blocks of data."

With respect to Claim 18, an analogous art, Hitz, teaches: "...wherein at least one block of data stored in the log is referenced by more than one of other blocks of data" [Hitz, col. 18, lines 24-30 with Hitz, col. 2, lines 25-36].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine Hitz with Zwilling because both inventions are directed towards storing files on file systems.

Hitz's invention would have been expected to successfully work well with Zwilling's invention because both inventions use file systems on computers. Zwilling discloses an on-line dynamic file shrink facility comprising trees/tables for file information/representation, however Zwilling does not expressly disclose the possibility that the blocks of data could be repeating by what is known in the art as aliases, shortcuts, or symbolic links. Hitz discloses a write anywhere file-system layout comprising file block indirection.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the file block indirection from Hitz and install it into the method of Zwilling, thereby offering the obvious advantage of extending Zwilling's invention to work on files that contain the same data in attempts to save space as the snapshot size increases thereby increasing the number of active snapshots in Hitz.

47. **Claim 50** encompasses substantially the same scope of the invention as that of Claim 18, in addition to a machine-readable medium and some instructions for performing the method steps of Claim 18. Therefore, Claim 50 is rejected for the same reasons as stated above with respect to Claim 18.

48. For **Claim 24**, Zwilling teaches: "The system of claim 20."

Zwilling discloses the above limitation but does not expressly teach: "...wherein at least one of the number of blocks of data are referenced by more than one reference."

With respect to Claim 24, an analogous art, Hitz, teaches: "...wherein at least one of the number of blocks of data are referenced by more than one reference" [Hitz, col. 18, lines 24-30 with Hitz, col. 2, lines 25-36].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine Hitz with Zwilling because both inventions are directed towards storing files on file systems.

Hitz's invention would have been expected to successfully work well with Zwilling's invention because both inventions use file systems on computers. Zwilling discloses an on-line dynamic file shrink facility comprising trees/tables for file information/representation, however Zwilling does not expressly disclose the possibility that the blocks of data could be repeating bywhat is known in the art as aliases, shortcuts, or symbolic links. Hitz discloses a write anywhere file-system layout comprising file block indirection.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the file block indirection from Hitz and install it into the method of Zwilling, thereby offering the obvious advantage of extending Zwilling's invention to work on files that contain the same data in attempts to save space as the snapshot size increases thereby increasing the number of active snapshots in Hitz.

49. For **Claim 27**, Zwilling teaches:

- "...each leaf node of said set of storage trees to include a block of data from said file system [Zwilling, col. 10, lines 5-13 with Zwilling, col. 8, lines 46-65]
- a storage space to store said blocks of data having been allocated... in said set of storage devices [Zwilling, col. 5, lines 29-52 with Zwilling, Fig. 2]
- ...having stored therein a minimum address value of descendent nodes of interior nodes of said set of storage trees; [Zwilling, cols. 8-9, lines 46-15 with Zwilling, col. 9, lines 43-51 with Zwilling col. 8, lines 20-35 with Zwilling, col. 7, lines 38-21] and
- a garbage collection logic to clean a currently selected range from the tail of said log, [Zwilling, col. 5, lines 29-52 with Zwilling, Fig. 2] said garbage collection logic to prune walking of nodes of said set of storage trees based on said set of location tables and said currently selected range" [Zwilling, cols. 8-9, lines 46-17 with Zwilling, col. 5, lines 29-52 with Zwilling, col. 12, lines 24-40].

Zwilling discloses the above limitations but does not expressly teach: "A backup system comprising:

- a set of one or more storage trees, each representing a snapshot of a file system at a different time...that has been backed up from a set of one or more storage devices...
- from a backup storage space...
- a set of one or more location tables."

With respect to Claim 27, an analogous art, Hitz, teaches: "A backup system [Hitz, col. 17, lines 40-50] comprising:

- a set of one or more storage trees, each representing a snapshot of a file system at a different time [Hitz, cols. 17-18, lines 50-14]...that has been backed up from a set of one or more storage devices [Hitz, cols. 17-18, lines 65-14]...
- from a backup storage space [Hitz, cols. 17-18, lines 65-14]...
- a set of one or more location tables" [Hitz, cols. 17-18, lines 65-14 with Zwilling, col. 10, lines 5-13].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine Hitz with Zwilling because both inventions are directed towards storing files on file systems.

Hitz's invention would have been expected to successfully work well with Zwilling's invention because both inventions use file systems on computers. Zwilling discloses an on-line dynamic file shrink facility comprising a storage tree, location table, and garbage collection, however Zwilling does not expressly disclose multiple trees, or tables as relating to snapshots of storage device(s). Hitz discloses a write anywhere file-system layout comprising storage trees from snapshots of a file system.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the storage device (making 2 storage devices) and the storage trees of snapshots from Hitz and install it into the system of Zwilling, thereby offering the obvious advantage of extending Zwilling's invention to work on archived (snapshot) files in attempts to save space as the snapshot size increases thereby increasing the number of active snapshots in Hitz.

Different embodiments of Zwilling are use in the rejection for Claim 27 and its respective dependant claims. Zwilling (as modified by Hitz) teaches all of Claim 27 with assistance from Zwilling's different embodiments.

50. **Claim 28** can be mapped to Zwilling (as modified by Hitz) as follows: "The backup system of claim 27, wherein two different nodes of a same storage tree reference a same node in the same storage tree" [Hitz, col. 18, lines 24-30 with Hitz, col. 2, lines 25-36].

51. **Claim 29** can be mapped to Zwilling (as modified by Hitz) as follows: "The backup system of claim 27, wherein the garbage collection logic is to update references to a node that is within the currently selected range based on an update to an entry in the set of one or more location tables" [Zwilling, Fig. 3C with Zwilling, col. 8, lines 29-33 with Zwilling, col. 9, lines 4-7].

52. **Claim 30** can be mapped to Zwilling (as modified by Hitz) as follows: "The backup system of claim 27, wherein the garbage collection logic is to prune walking of the nodes of said set of storage trees based on the minimum addresses stored in the set of one ore more location tables" [Zwilling, cols. 8-9, lines 46-17 with Zwilling, col. 5, lines 29-52 with Zwilling, col. 12, lines 24-40 with Zwilling, col. 10, lines 5-13].

53. For **Claim 31**, Zwilling teaches: "An apparatus [Zwilling, cols. 4-5, lines 62-12] comprising:

- "...by recording references to blocks of backed up data [Zwilling, cols. 8-9, lines 46-17 with Zwilling, col. 10, lines 5-13]

- ...an allocator logic to allocate contiguous blocks of storage space from a log of a backup storage space to store said blocks of backed up data [Zwilling, col. 5, lines 29-52 with Zwilling, col. 12, lines 24-40]
- a garbage collection logic to...clean a currently selected contiguous range from the tail of said log, [Zwilling, col. 5, lines 29-52, with Zwilling, Fig. 2] said garbage collection logic to,
  - walk only those nodes of said set of storage trees that possibly identify those of said blocks of data that are stored in said currently selected contiguous range or that possibly are themselves stored in said currently selected contiguous range, [Zwilling, cols. 8-9, lines 46-14 with Zwilling, col. 9, lines 43-50] and
  - sweep said currently selected contiguous range" [Zwilling, col. 5, lines 29-52, with Zwilling, Fig. 2].

Zwilling discloses the above limitations but does not expressly teach:

- "...a backup system to backup a file system, said backup file system including,
  - a tracking logic to generate a set of trees each representing backup snapshots of said file system at different times...stored in a set of one more storage devices
  - ...responsive to deletion of one or more of said backup snapshots."

With respect to Claim 31, an analogous art, Hitz, teaches: "

- "...a backup system [Hitz, col. 17, lines 40-50] to backup a file system, [Hitz, cols. 17-18, lines 65-14] said backup file system including,

- a tracking logic to generate a set of trees each representing backup snapshots of said file system at different times [Hitz, cols. 17-18, lines 65-14]...stored in a set of one more storage devices [Hitz, cols. 17-18, lines 65-14]
- ...responsive to deletion of one or more of said backup snapshots" [Hitz, cols. 17-18, lines 65-14].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine Hitz with Zwilling because both inventions are directed towards storing files on file systems.

Hitz's invention would have been expected to successfully work well with Zwilling's invention because both inventions use file systems on computers. Zwilling discloses an on-line dynamic file shrink facility comprising a storage tree, location table, and garbage collection, however Zwilling does not expressly disclose multiple trees, or tables as relating to snapshots of storage device(s). Hitz discloses a write anywhere file-system layout comprising storage trees from snapshots of a file system.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the storage device (making 2 storage devices) and the storage trees of snapshots from Hitz and install it into the system of Zwilling, thereby offering the obvious advantage of extending Zwilling's invention to work on archived (snapshot) files in attempts to save space as the snapshot size increases thereby increasing the number of active snapshots in Hitz.

Different embodiments of Zwilling are use in the rejection for Claim 31 and its respective dependant claims. Zwilling (as modified by Hitz) teaches all of Claim 31 with assistance from Zwilling's different embodiments.

54. **Claim 32** can be mapped to Zwilling (as modified by Hitz) as follows: "The apparatus of claim 31, wherein the set of trees include interior nodes and leaf nodes, [Zwilling, col. 8, lines 10-20 with Zwilling, cols. 8-9, lines 46-14] the interior nodes to include references to other nodes in the set of one or more storage trees, [Zwilling, cols. 8-9, lines 46-14] two different interior nodes of a same tree references a same node in the same tree" [Hitz, col. 18, lines 24-30 with Hitz, col. 2, lines 25-36].

Conclusion

55. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Applicant is advised that, although not used in the rejections above, prior art cited on the PTO-892 form and not relied upon is considered materially relevant to the applicant's claimed invention and/or portions of the claimed invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brent S. Stace whose telephone number is 571-272-8372. The examiner can normally be reached on M-F 8:30am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Safet Metjahic can be reached on 571-272-4023. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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